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Marnay et al.

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(54) **INTERVERTEBRAL IMPLANT, INSERTION TOOL AND METHOD OF INSERTING SAME**

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(73) Assignee: **DePuy Synthes Products, Inc.**, Raynham, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(65) **Prior Publication Data**

US 2014/0052261 A1 Feb. 20, 2014

Related U.S. Application Data

(63) Continuation of application No. 13/347,461, filed on Jan. 10, 2012, now Pat. No. 8,579,978, which is a continuation of application No. 11/669,273, filed on Jan. 31, 2007, now Pat. No. 8,105,381, which is a continuation of application No. 10/318,078, filed on Dec. 13, 2002, now Pat. No. 7,204,852.

(51) **Int. Cl.**

A61F 2/44	(2006.01)
A61F 2/46	(2006.01)
A61F 2/30	(2006.01)

(52) **U.S. Cl.**

CPC ***A61F 2/4425*** (2013.01); ***A61F 2/4611*** (2013.01); *A61F 2002/305* (2013.01);

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(58) **Field of Classification Search**

CPC A61F 2/442; A61F 2/4425; A61F 2/44; A61F 2002/443; A61F 2002/444; A61F 2/4611; A61F 2002/4628

USPC .... 606/86 A, 99–100, 279, 914; 623/17.11–17.16

See application file for complete search history.

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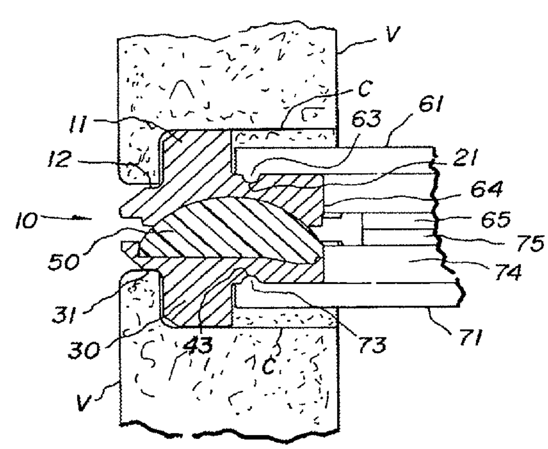
(74) *Attorney, Agent, or Firm* — Baker & Hostetler LLP

(57) **ABSTRACT**

An intervertebral implant, alone and in combination with an insertion tool for inserting same and a method for inserting same. The implant has upper and lower parts which have universal movement relative to each other. Each of the upper and lower parts also has a surface engaging an adjacent vertebrae. Each part has a keel extending from said surface into a cutout in the adjacent vertebrae, and each keel has an anterior opening recess therein. An insert tool has a pair of arms which are received in the recess of the keels through the anterior opening to securely hold and insert the implant. Projections and matching indentations in each arm and the base of its recess securely attached each arm within its keel.

23 Claims, 8 Drawing Sheets



(52) **U.S. Cl.**
CPC *A61F2002/30383* (2013.01); *A61F 2002/30604* (2013.01); *A61F 2002/30616* (2013.01); *A61F 2002/30662* (2013.01); *A61F 2002/30884* (2013.01); *A61F 2002/443* (2013.01); *A61F 2002/4628* (2013.01); *A61F 2220/0025* (2013.01); *A61F 2310/00023* (2013.01); *A61F 2310/00029* (2013.01); *A61F 2310/00179* (2013.01); *A61F 2310/00407* (2013.01)

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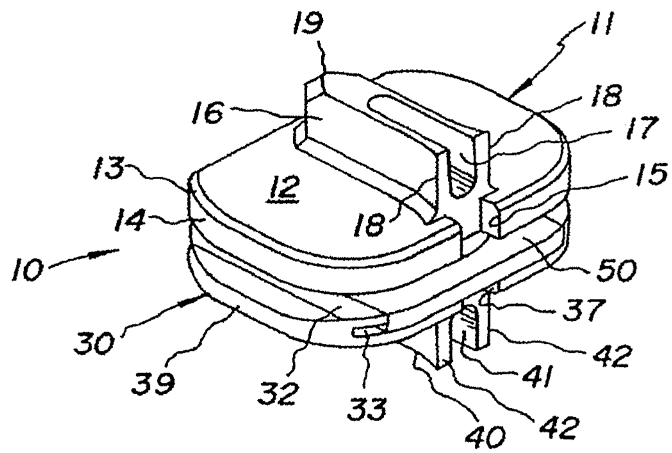
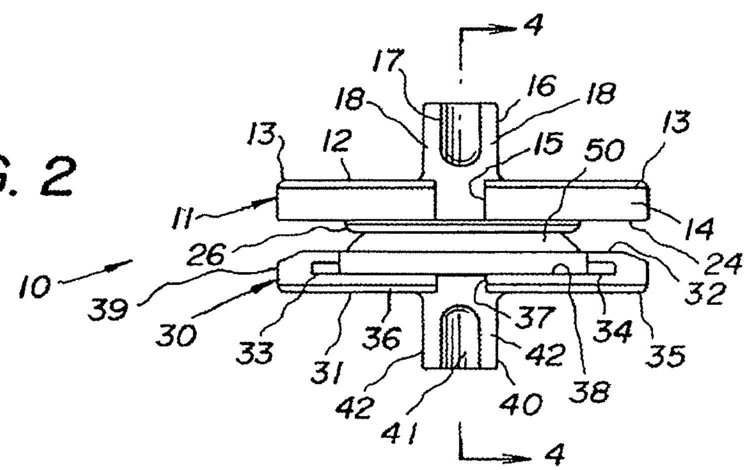
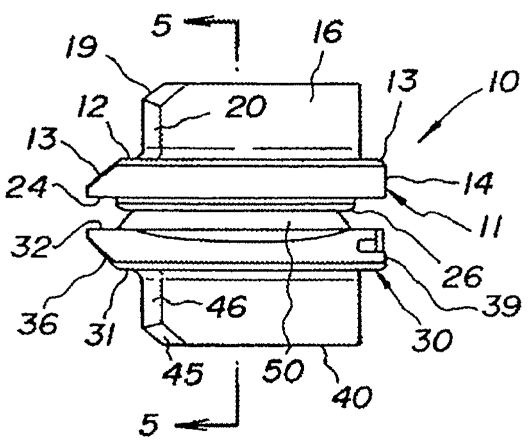


FIG. 1

FIG. 2





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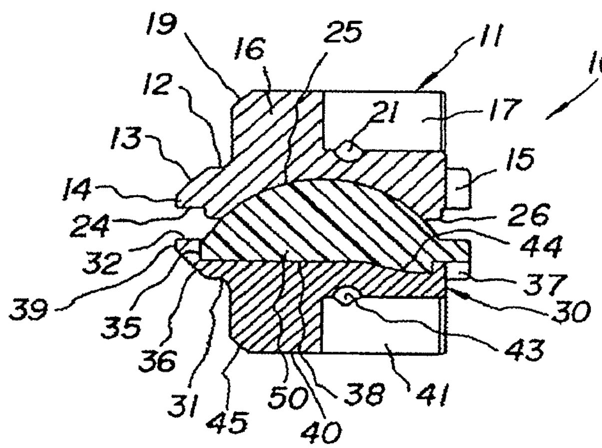
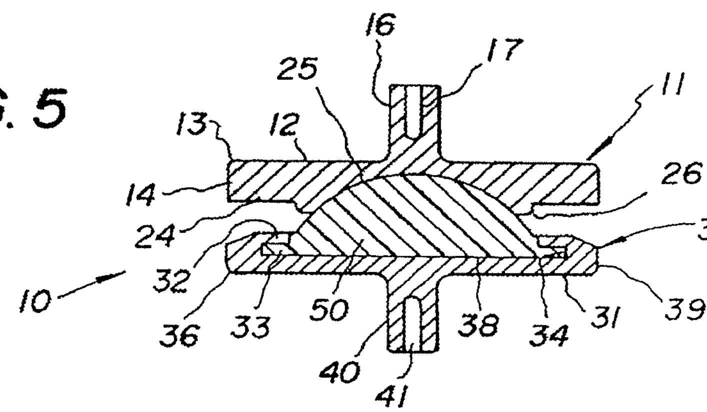
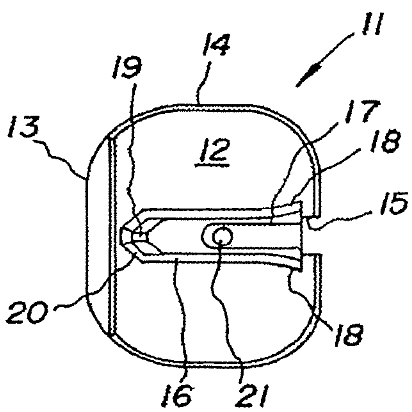


FIG. 4

FIG. 5





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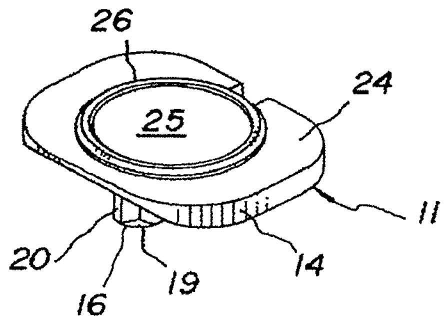
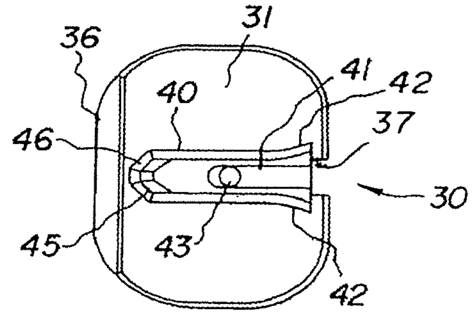
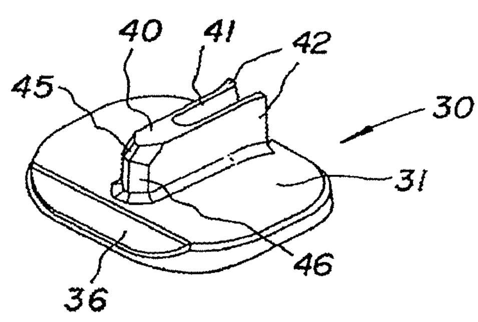


FIG. 7

FIG. 8





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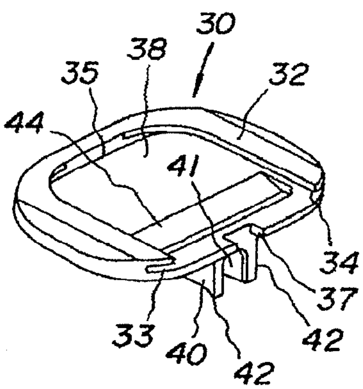

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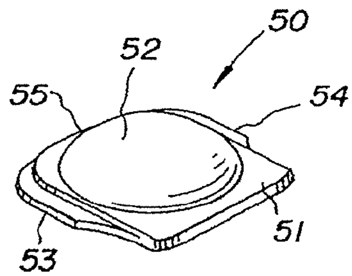

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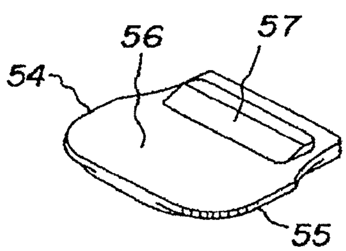

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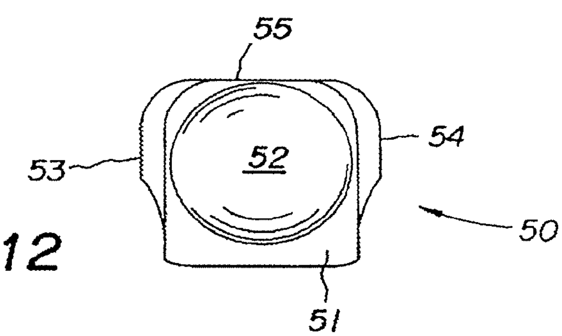

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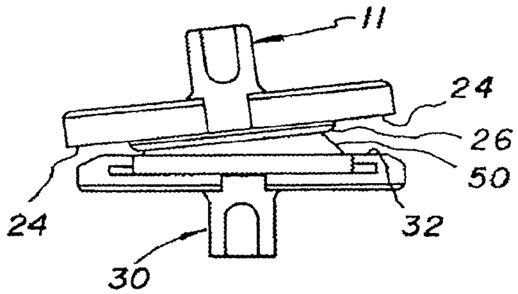

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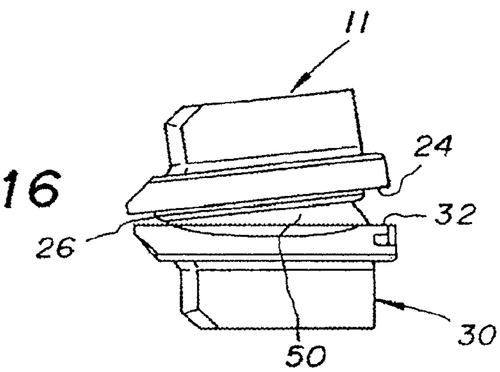

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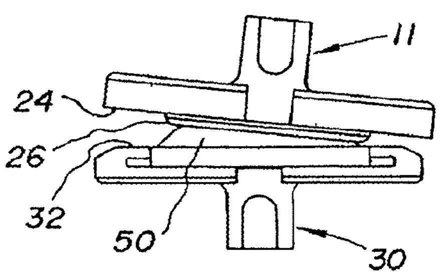


FIG. 15

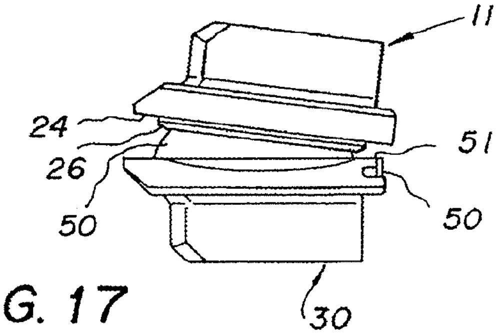
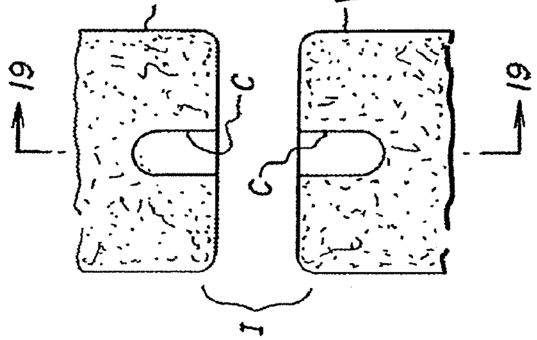


FIG. 17

FIG. 18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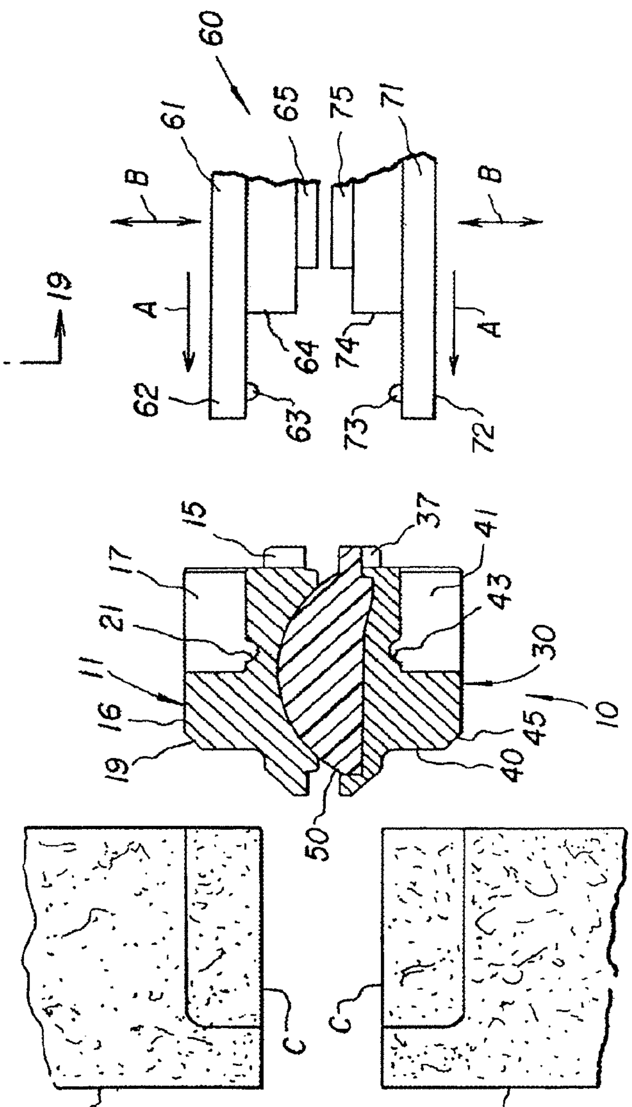
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FIG. 19

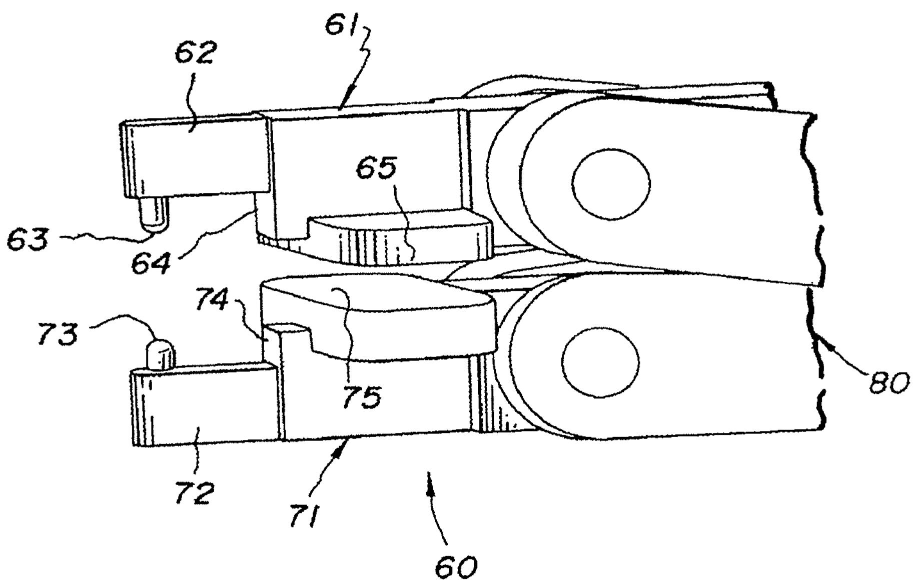

FIG. 20

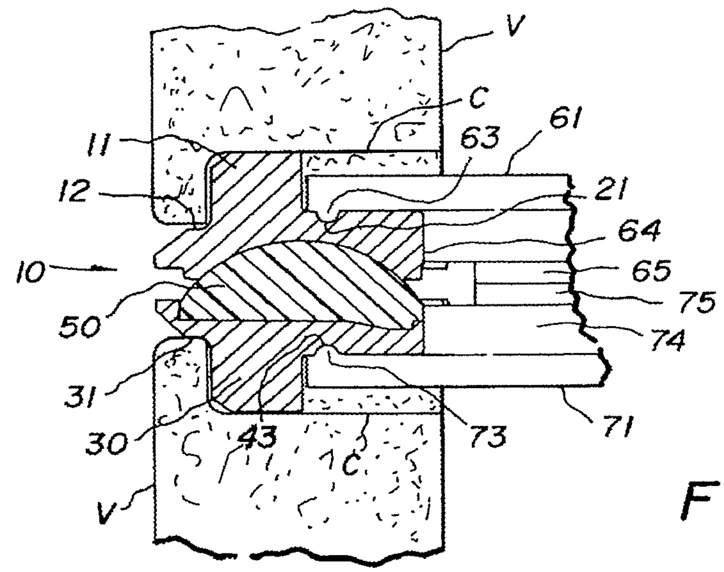

FIG. 21

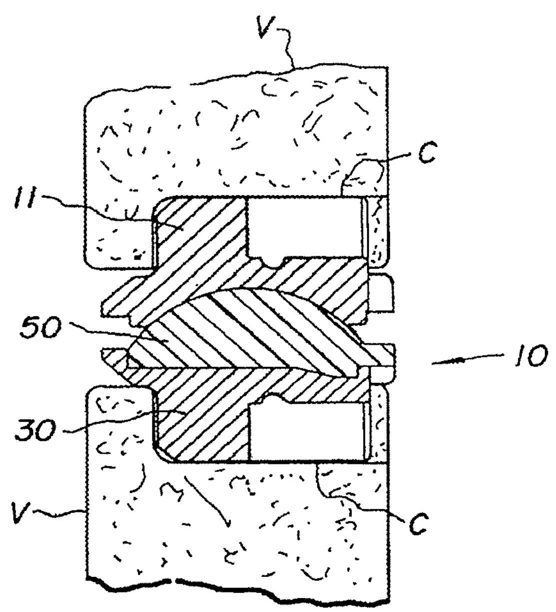

FIG. 22

INTERVERTEBRAL IMPLANT, INSERTION TOOL AND METHOD OF INSERTING SAME

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 13/347,461 filed Jan. 10, 2012 which is a continuation of U.S. patent application Ser. No. 11/669,273 filed Jan. 31, 2007, now U.S. Pat. No. 8,105,381 issue date Jan. 31, 2012; which is a continuation of U.S. patent application Ser. No. 10/318,078 filed Dec. 13, 2002, now U.S. Pat. No. 7,204, 852 issue date Apr. 17, 2007; the disclosures of which are hereby incorporated by reference herein in their entireties.

FIELD OF THE INVENTION

This invention relates to intervertebral implants, and in particular, to a new and improved intervertebral implant and to an insertion tool and a method for inserting same.

BACKGROUND OF THE INVENTION

Historically, when it was necessary to completely remove a disc from between adjacent vertebrae, the normal remedy was to fuse the adjacent vertebrae together. More recently, there have been important developments in the field of disc replacement, namely disc arthroplasty which involves the insertion of an artificial intervertebral implant into the intervertebral space between adjacent vertebrae and which allows movement of the adjacent vertebrae relative to each other in flexion, extension, lateral bending, axial rotation and translation, as well as absorbing axial compression.

One such development is an artificial intervertebral implant as shown in Published Application No. WO 01/01893, published Jan. 11, 2001. The instruments for inserting same are shown in Published Application No. WO 01/19295, published Mar. 22, 2001.

While the intervertebral implant and instruments as shown in these publications represents a substantial improvement in the art, there exists a continuing need for improvements in the field of artificial intervertebral implants.

One such area in need of further improvements includes intervertebral implants for the intervertebral spaces between adjacent cervical vertebrae. This is because the cervical vertebrae and the dimensions of the intervertebral spaces between them are quite small. For example, the area of the cervical vertebral surfaces facing the adjacent cervical intervertebral spaces may be only about 20 percent of the intervertebral surfaces of the vertebrae in the lumbar region, thereby making this an extremely delicate area in which to insert an intervertebral implant.

BRIEF SUMMARY OF THE INVENTION

The purpose of the present invention is to provide a new and improved intervertebral implant, an insertion tool and a method for inserting same which are highly advantageous in the delicate and difficult area of the cervical spine. It is to be noted, however, that while the present invention has been developed particularly for the cervical spine, the invention is equally applicable for inserting an intervertebral implant at any location in the spine, including the lumbar spine.

Thus, although the invention has been developed and is particularly advantageous for the cervical spine, it will be

described below more generally as an intervertebral implant without specifically identifying any particular portion of the spine.

It is thus an object of the present invention to provide a new and improved intervertebral implant together with an insertion tool and a method for inserting same.

It is another object of the present invention to provide an insertion tool and a method for inserting the new improved intervertebral implant.

In accordance with the present invention, there is provided an intervertebral implant having an upper part and a lower part which are operatively engaged for limited universal movement relative to each other. The upper part has a keel which is received in a cutout in the adjacent vertebrae, while the lower part has a keel which is received in a cutout in the other adjacent vertebrae. In accordance with a main feature of the present invention, these keels, in addition to providing an anchoring function within the adjacent vertebrae, include a recess open at an end thereof for receiving arms of an insertion tool. This has the advantage of allowing grasping the implant firmly but over a very limited area for inserting the implant into the intervertebral space with minimal invasion of the work area by the insertion tool.

The upper part preferably has a spherical concave portion formed in its lower surface. The lower part preferably has a plastic inlay attached thereto, which inlay has a raised spherical convex portion which engages the spherical concave portion of the upper part to provide the limited universal movement between the two.

The insertion tool usable in combination with the implant preferably has a pair of arms, each of which engages a recess within a keel, each arm having a projection which is moved toward the base of the recess to engage indentations in the base of the recesses to firmly hold the implant. The arms also include lateral support portions which engage support cutouts on the upper and lower parts to absorb lateral forces exerted on the implant so that such lateral forces do not have to be absorbed by the more delicate portions of the insertion tool arms located within the recesses of the keels.

The method of present invention comprises engaging an intervertebral implant of the type described with an insertion tool of the type described, inserting the intervertebral implant into the intervertebral space with the keels entering cutouts in the adjacent vertebrae, and then removing the insertion tool from the intervertebral implant, leaving the intervertebral implant in place within the intervertebral space.

Thus, it is an object of the present invention to provide a new and improved intervertebral implant.

It is another object of the present invention to provide an insertion tool and a method for inserting the new improved intervertebral implant.

It is another object of the present invention to provide an intervertebral implant which is particularly suitable for the cervical spine.

It is another object of the present invention to provide a new and improved intervertebral implant characterized by a recess in raised keels for receiving insertion tools for inserting the intervertebral implant.

These and other objects of the present invention will be apparent from the detailed description to follow, together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention will now be described by way of example with reference to the accompanying drawings, wherein:

FIG. **1** is a perspective view of an intervertebral implant in accordance with the present invention;

FIG. **2** is a front elevational view of the implant of FIG. **1**;

FIG. **3** is a left side elevational view of the implant of FIG. **1**;

FIG. **4** is a cross sectional view taken along line **4-4** of FIG. **2**;

FIG. **5** is a cross sectional view taken along line **5-5** of FIG. **3**;

FIG. **6** is a top plan view of the upper part of the implant of FIG. **1**;

FIG. **7** is a perspective view of the bottom surface of the upper part of the implant of FIG. **1**;

FIG. **8** is a bottom plan view of the lower part of the implant of FIG. **1**;

FIG. **9** is a bottom perspective view of the lower part of the implant of FIG. **1**;

FIG. **10** is a top perspective view of the lower part of the implant of FIG. **1**;

FIG. **11** is a top perspective view of the plastic inlay of the implant of FIG. **1**;

FIG. **12** is a top plan view of the plastic inlay of the implant of FIG. **1**;

FIG. **13** is a bottom perspective view of the plastic inlay of the implant of FIG. **1**;

FIGS. **14-17** are elevational views of the implant of FIG. **1** illustrating the limited universal movement of the parts thereof;

FIG. **18** is a schematic view of a pair of adjacent vertebrae prepared to receive an implant of the present invention in the intervertebral space therebetween;

FIG. **19** illustrates the vertebrae of FIG. **18**, in a direction along line **19-19** of FIG. **18** and showing the implant itself about to be inserted and showing an insertion tool prior to engaging the implant;

FIG. **20** illustrates a portion of an insertion tool for use with the implant of the present invention;

FIG. **21** illustrates the vertebrae of FIG. **18** with the implant in place therein and the insertion tool still holding the implant in the same position in which it held the implant during insertion; and

FIG. **22** illustrates the vertebrae with the implant in place and the insertion tool removed.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to the figures, like elements are represented by like numerals throughout the several views.

In this application, the words "upper" or "lower" or "uppermost" or "lowermost" or any other words describing the orientation of the intervertebral implant of the present invention are used only for convenience and are not intended to convey any limitation. More specifically, the part of the implant described in this application as the upper part can in fact be positioned as the superior or inferior part within the patient's vertebrae with the other of the two parts being the opposite part. Also, since the intervertebral implant is normally inserted from the front of the patient, the side of the vertebrae toward which the intervertebral implant moves as it is inserted shall be referred to as the anterior side of the vertebrae and the opposite side as the posterior side and the right and left sides as lateral sides. Since the more common manner of insertion is anteriorly, the present invention will be described with respect to that orientation. Also, the posterior end of the implant may be referred to as the first end and the anterior end of the implant may be referred to as the second end. However, it is to be understood that the intervertebral implant can also be inserted laterally, i.e., from the side, in which case the keels will be oriented on the implant for such lateral movement and the cutouts in the adjacent vertebrae will be open toward a lateral side to receive the keel.

FIGS. **1-5** illustrate in different views the assembled intervertebral implant **10** including an upper part, or component, **11**, a lower part, or component, **30** and a plastic inlay, or insert, **50** located therebetween but connected to the lower part **30**.

The intervertebral implant of the present invention has been designed primarily for insertion in the cervical spine. This portion of the spine is characterized by the need for precision because of the relatively small dimensions of the cervical intervertebral space. For example, the implant of the present invention, when viewed in plan view (as best seen for example in FIG. **6**) would be approximately 12-16 millimeters in width and approximately 15-19 millimeters in length. It has been found practical to provide three sizes, 12 millimeters×15 millimeters, 14 millimeters×17 millimeters and 16 millimeters×19 millimeters. The height of the implant, meaning the height from the upper surface of the upper part to the lower surface of the lower part, excluding the keels, would normally be between 5 millimeters and 9 millimeters. These dimensions are in contrast to an intervertebral disc to be located in the lumbar area wherein the rectangular portion would have dimensions more on the order of 27 to 30 millimeters in width, 34 to 39 millimeters in length, and a height of about 10 to 14 millimeters. However, it is to be understood that the features of the present invention are equally adaptable for an intervertebral implant of a different size and design for construction in any other part of the spine including the lumbar spine.

The upper part **11** will now be described in detail with respect to FIGS. **1-5** which illustrate the assembled implant and FIGS. **6** and **7** which illustrate only the upper part **11**. The upper part **11** includes an upper surface, or outer side, **12** which engages and supports the adjacent vertebral surface. This upper surface **12** is bounded by edges which are slightly beveled all the way around as shown at **13** with the largest portion of this bevel being along the posterior surface. Below the beveled edge **13**, the upper part is bounded by a surrounding side wall **14** which has an anterior support cutout **15**. Thus, in the figures the keels are shown oriented anterior to posterior with the solid portion of the keels facing posteriorly and the insertion engaging recess structure facing anteriorly.

Rising above the upper surface **12** of the upper part **11** is a keel **16** which includes a recess **17** formed therein. This recess is opened upwardly and anteriorly. Referring to FIGS. **4** and **6**, this recess includes an indentation **21** in the base thereof. The posterior end of the keel **16** comprises a V-shaped upper bevel **19** and a V-shaped vertical portion **20**, providing a front which is "arrow" shaped, as best seen in FIG. **6**. The purpose of this "arrow" shape is to facilitate insertion of the keel into a cutout formed in the adjacent vertebrae. The anterior opening of the recess is flared at **18**, which flare serves to anchor the anterior end of the keel **16** in its cutout in the adjacent vertebrae.

The upper part **11** includes a lower plane inner surface **24** which includes, as best seen in FIG. **7**, a raised rim **26** which defines a rounded surface such as a concave spherical portion **25**, which surface, along with a mating surface, provide for universal movement relative to each other. As best shown in FIGS. **4** and **5**, this spherical concave portion **25** will mate with an upper convex surface of the plastic inlay **50**.

The lower part **30** is described with reference to FIGS. **1-5** and also FIGS. **8-10** which show isolated views of the lower part **30**.

The lower part **30** includes a lower vertebrae supporting and engaging surface, or outer side, **31** and an inner upper surface **32**. As best seen in FIGS. **2**, **5** and **10**, this lower part includes grooves **33** and **34** formed in the interior side wall thereof beneath surface **32** and above a base surface **38**. A substantially flat back wall **35** extends from base surface **38** to upper surface **32**. This lower part includes a beveled edge **36** extending around the periphery of the lower surface **31** with a most pronounced bevel at the posterior thereof and a surrounding side wall **39**. The purpose of the grooves **33** and **34** is to receive side flanges **53** and **54** of a plastic inlay **50**, as shown in FIG. **11** and as will be described in greater detail below.

Lower part **30** includes an anterior support cutout **37**. A keel **40** rises upwardly (or in the usual orientation, extends downwardly) from the lower surface **31**. This keel includes a recess **41** which opens downwardly and anteriorly and has a flared anterior entrance to the recess at **42**, which flared entrance serves the same function as flared entrance **18** of upper part **11**, i.e., to facilitate engagement of the anterior end of the keel within its cutout in the vertebrae. As best shown in FIG. **4**, the recess **41** opens downwardly and anteriorly and includes an indentation **43**. The keel **40** includes at its posterior end a V-shaped lower bevel **45** and a V-shaped vertical portion **46** which together provide an "arrow" shape, as best seen in FIG. **8** to facilitate insertion of the keel into its cutout formed in the adjacent vertebrae. As seen in the figures, the recesses run along an anterior-posterior line of the implant.

Referring momentarily to FIG. **13**, it will be noted that the lower surface of the plastic inlay **50** includes a raised snap-in projection **57**. Referring now to FIG. **10**, there is illustrated a snap-in recess **44** which is adapted to receive the snap-in projection **57** such that the plastic inlay can snap into place but is thereafter prevented from being removed. This snap fit is also shown clearly in FIG. **4**. It will be noted, however, that while removal would not occur under normal circumstances, in fact it is possible at a subsequent time, by inserting a tool between the base of the lower part and the plastic inlay to pry the plastic inlay out and remove it. This might be useful, for example, if it were decided to insert a new plastic inlay of a different size or if it became necessary to repair the previously inserted plastic inlay.

The upper and lower parts are made of a suitable material such as titanium, cobalt chromium molybdenum, stainless steel or ceramics. The upper surface of the upper part and the lower surface of the lower part as well as the side surfaces of the keels are coated with a porous coating of titanium. The porosity of the coating ideally permits vascularization and osteoplast formation with subsequent bony on-growth.

The plastic inlay **50** is visible in FIGS. **1-5**. However, for convenience the numerals pointing to details thereof are not included in any of those figures, but instead are provided in FIGS. **11-13**. It is preferably made of high density polyethylene. FIG. **11** illustrates the plastic inlay **50** in its position as shown in FIG. **1**. It includes a flat upper surface **51** having attached thereto a rounded surface such as a convex spherical portion **52**, which surface mates with the concave spherical portion **25** of the upper part **11** to provide for universal movement. Side flanges **53** and **54** engage the grooves **33** and **34** in the lower part **30**. A flat posterior wall **55** engages the posterior wall **35** of the lower part.

Referring to FIG. **13**, the plastic inlay **50** includes a generally flat lower surface **56** which engages the base surface **38** of the lower part and a snap-in projection **57** which is beveled on the posterior side and includes a sharp ledge on the anterior side so as to snap into place in the recess **44** of base surface **38** to the position as best shown in FIG. **4**.

FIGS. **14-17** illustrate the limited universal movement of the upper and lower parts of the implant relative to each other when inserted in a patient's intervertebral space. FIGS. **14** and **15**, both of which view the anterior of the implant, show maximum lateral bending to the left and right, respectively. It will be noted that in each case the raised rim **26** of the upper part **11** engages the inner surface **32** of the lower part **30**. In a preferred embodiment, such lateral bending movement is possible for up to approximately 10.5° for the smaller of the three sizes and approximately 8.9° for the two larger sizes, relative to a reference position wherein the keels are aligned vertically. FIG. **16**, which shows a view from the right side of the patient, shows extension movement of the upper part relative to the lower part which is limited by engagement of the rim **26** with the inner surface **32** of the lower part **30**. Finally, FIG. **17**, which is a view from the patient's left side, shows maximum flexion of the upper part **11** relative to the lower part **30**. Flexion is limited by engagement of the rim **26** with the surface **51** of the inlay **50**. In preferred embodiments, extension and flexion can occur up to approximately 10.5° for the smaller three sizes and approximately 8.9° for the two larger sizes, relative to a reference position wherein the keels are vertically aligned. As is apparent from the preceding discussion, the term "limited" as applied to universal movement refers to the limited range in each direction, as described above. However, as is also apparent, within that range, the movement is conventional universal movement in the sense that movement is allowed in all directions.

FIGS. **18-22** illustrate the method of insertion of the implant shown in FIGS. **1-17** and a portion of a handling instrument such as an insertion tool for use for inserting the implant.

FIG. **18** is an anterior view of a pair of adjacent vertebrae V on opposite sides of a cleaned-out intervertebral space I. In preparation for inserting the intervertebral implant of the present invention, cutouts C will be formed in the vertebrae V. As shown in FIG. **18** and the left hand portion of FIG. **19**, these cutouts start from the anterior of the vertebrae and extend for most but not all of the distance toward the posterior of the vertebrae, intersecting along its entire length with the surface of the vertebrae facing into the intervertebral space.

FIG. **19** illustrates just to the right of the prepared adjacent vertebrae the intervertebral implant assembled in the form as shown in FIGS. **1-5**. To the right thereof is an insertion tool **60** which is to be described with respect to FIGS. **19** and **20**. This insertion tool **60** includes an upper arm **61** and a lower arm **71**, which arms are arranged to move towards and away from each other as indicated by the arrows B in FIG. **19**. Various devices can be provided for moving these arms towards and away from each other. One such mechanism in the form of a scissors is partially shown at **80** in FIG. **20**. The upper and lower arms include keel engaging portions **62** and **72** which engage recesses **17** and **41**, respectively. These arms include towards their outer ends projections **63** and **73** which are constructed to be received in the indentations **21** and **43**, respectively. It will be noted that these keel engaging portions **62** and **72** are relatively narrow. In fact, it is contemplated that the entire width of each keel will be approximately 2 millimeters, thus allowing less than 2 millimeters for the actual recesses. The arms **61** and **71** also include lateral support surfaces **64** and **74** which, upon engagement of the tool with the implant, will engage the front support cutouts **15** and **37**.

The arms **61** and **71** will be spaced apart from each other just enough for the projections **63** and **73** to clear the bottoms of the recesses **17** and **41** until the projections **63** and **73** reach the indentations **21** and **43**, at which time the arms **61** and **71** will be moved towards each other such that the projections **63** and **73** engage within the indentations **21** and **43** and the lateral support surfaces **64** and **74** are engaged within the cutouts **15** and **37**. At this position, abutment surfaces **65** and **75** on the upper arm and lower arm **61** and **71**, respectively, will abut each other, thus limiting further movement of the arms **61** and **71** towards each other.

With the assembled implant thus attached to the insertion tool, the insertion tool moves it into the intervertebral space with the keels **16** and **40** entering the cutouts C, while the portions of the upper and lower parts **11** and **30** posterior of the keels extends within the intervertebral space beyond the cutouts C so that upper surface **12** engages the intervertebral surface of the adjacent vertebrae V posterior of and adjacent to the keel **16** and surface **31** of the lower part **30** engages the intervertebral surface of the adjacent lower vertebrae posterior and adjacent to the keel **40**. Actually, the above described engagement of the insertion tool **60** and the implant **10** prior to insertion is the same as shown in FIG. **21**, just after insertion.

It will be noted that in FIG. **21** there is a space above and below the arms **61** and **71** within keel recesses **17** and **41**, the vertical dimension of which spaces is greater than the height of the projection **63** and **73**, which would normally be about 1.2 millimeters. This is necessary so that the arms **61** and **71** can be moved upwardly and downwardly, respectively, away from the base of their respective recesses to free the projections from the indentations before the upper and lower surfaces of arms **61** and **71** engage the vertebrae at the vertical extremities of the cutouts C. Such contact is to be avoided. Once these arms have been separated accordingly, they can be moved out from the implant, anteriorly, leaving the implant in place as shown in FIG. **22**.

The method of the present invention will be apparent from the above described operation of the invention as shown and described with respect to FIGS. **18-22**. In accordance with this method of the present invention, adjacent vertebrae are provided with cutouts in the manner described and an intervertebral implant of the type described is grasped with an insertion tool having arms which are received in the recesses of the keels through the anterior openings thereof. With the implant firmly grasped by the insertion tool, the implant is inserted anteriorly with the keels leading the way into the cutouts until the proper position has been reached. At this time, naturally some force will have been exerted to distend the adjacent vertebrae from each other, but preferably just enough to allow the implant to be inserted. In fact, many professionals prefer to distend the adjacent vertebrae no more than essentially the width between the upper and lower surfaces **12** and **31** and then apply additional external force with a mallet or the like to complete insertion of the implant. After the implant has been inserted, the arms of the insertion tool are separated just enough to free the projection/indentation engagements from each other, whereupon the insertion tool is removed anteriorly, leaving the implant in place and relieving any previously applied forces applied to distend the adjacent vertebrae from each other, allowing these adjacent vertebrae to rest upon the supporting surfaces **12** and **31** of the implant.

Although the invention has been described in detail with respect to preferred embodiments thereof, it will be apparent to one skilled in the art that the invention is capable of numerous modifications and variations within the spirit and scope of the invention.

What is claimed is:

1. A method of inserting an intervertebral implant into an intervertebral disc space defined between a first vertebra and a second vertebra, the method comprising the steps of:

inserting an arm of an implant insertion instrument into a recess of the intervertebral implant by moving the implant insertion instrument relative to the intervertebral implant in an insertion direction, the recess being at least partially defined by first and second side walls of a keel of the intervertebral implant;

advancing the implant insertion instrument so as to insert the intervertebral implant into the intervertebral disc space until an upper surface of the intervertebral implant faces the first vertebra, a lower surface of the intervertebral implant that is opposite the upper surface faces the second vertebra, and the keel is positioned within a cutout defined by one of the first and second vertebrae; and

removing the arm of the implant insertion instrument from the recess of the intervertebral implant by moving the implant insertion instrument relative to the intervertebral implant in a direction opposite the insertion direction while the intervertebral implant remains in the intervertebral disc space.

2. The method of claim **1**, wherein during each of the inserting, advancing, and removing steps, the arm of the implant insertion instrument does not come into contact with either the first vertebra or the second vertebra.

3. The method of claim **1**, wherein the arm is a first arm, the recess is a first recess, the keel is a first keel, and the cutout is a first cutout the method further comprising the steps of:

inserting a second arm of the implant insertion instrument into a second recess of the intervertebral implant by moving the implant insertion instrument relative to the intervertebral implant in the insertion direction, the second recess being at least partially defined by first and second side walls of a second keel of the intervertebral implant;

advancing the implant insertion instrument so as to insert the intervertebral implant into the intervertebral disc space until the second keel is positioned within a second cutout defined by one of the first and second vertebrae; and

removing the second arm of the implant insertion instrument from the second recess of the intervertebral implant by moving the implant insertion instrument relative to the intervertebral implant in the direction opposite the insertion direction while the intervertebral implant remains in the intervertebral disc space.

4. The method of claim **3**, wherein at least one of both inserting steps, both advancing steps, and both removing steps are performed simultaneously.

5. The method of claim **3**, wherein the first cutout is defined by the first vertebra and the second cutout is defined by the second vertebra.

6. The method of claim **1**, further comprising, before the advancing step, the step of forming the cutout in one of the first and second vertebrae.

7. The method of claim **1**, further comprising, after the inserting step, the step of securing the implant insertion instrument to the intervertebral implant such that relative movement of the implant insertion instrument and the intervertebral implant in the direction opposite the insertion direction is prevented.

8. The method of claim **7**, wherein the securing step includes moving the arm within the recess such that a projection carried by one of the arm and the keel enters an indentation within the other of the arm and the keel.

9. The method of claim 1, wherein during the advancing step, the arm is positioned within the cutout.

10. A method of inserting an intervertebral implant into an intervertebral disc space defined between a first vertebra and a second vertebra, the method comprising the steps of:
inserting a portion of an implant insertion instrument into a recess of the intervertebral implant so as to couple the implant insertion instrument to the intervertebral implant, the recess being at least partially defined by first and second side walls of a keel of the intervertebral implant;
advancing the implant insertion instrument and the intervertebral implant in a first direction until an upper surface of the intervertebral implant faces the first vertebra, a lower surface of the intervertebral implant that is opposite the upper surface faces the second vertebra, and both the keel and the portion of the implant insertion instrument are positioned within a cutout defined by one of the first and second vertebrae; and
removing the portion of the implant insertion instrument from the recess of the intervertebral implant and the cutout by moving the implant insertion instrument relative to the intervertebral implant in a second direction opposite the first direction while the intervertebral implant remains in the intervertebral disc space.

11. The method of claim 10, wherein during each of the inserting, advancing, and removing steps, the portion of the implant insertion instrument does not come into contact with either the first vertebra or the second vertebra.

12. The method of claim 10, wherein the portion is a first portion, the recess is a first recess, the keel is a first keel, and the cutout is a first cutout the method further comprising the steps of:
inserting a second portion of the implant insertion instrument into a second recess of the intervertebral implant, the second recess being at least partially defined by first and second side walls of a second keel of the intervertebral implant;
advancing the implant insertion instrument and the intervertebral implant in the first direction until both the second keel and the second portion of the implant insertion instrument are positioned within a second cutout defined by one of the first and second vertebrae; and
removing the second portion of the implant insertion instrument from the second recess of the intervertebral implant and the second cutout by moving the implant insertion instrument relative to the intervertebral implant in the second direction while the intervertebral implant remains in the intervertebral disc space.

13. The method of claim 12, wherein at least one of both inserting steps, both advancing steps, and both removing steps are performed simultaneously.

14. The method of claim 12, wherein the first cutout is defined by the first vertebra and the second cutout is defined by the second vertebra.

15. The method of claim 10, further comprising, before the advancing step, the step of forming the cutout in one of the first and second vertebrae.

16. The method of claim 10, further comprising, after the inserting step, the step of securing the implant insertion instrument to the intervertebral implant such that relative movement of the implant insertion instrument and the intervertebral implant in the direction opposite the first direction is prevented.

17. The method of claim 16, wherein the securing step includes moving the arm within the recess such that a projection carried by one of the arm and the keel enters an indentation within the other of the arm and the keel.

18. A method of inserting an intervertebral implant into an intervertebral disc space defined between a first vertebra and a second vertebra, the method comprising the steps of:
inserting a portion of an implant insertion instrument into a recess of the intervertebral implant, the intervertebral implant defining a trailing end and a leading end spaced from the trailing end in a first direction, the intervertebral implant further defining a first side surface and a second side surface spaced from the first side surface in a second direction that is perpendicular to the first direction, the intervertebral implant also defining an upper surface and a lower surface that is movable relative to the upper surface, the recess being open to the trailing end and positioned substantially equidistantly between the first and second side surfaces with respect to the second direction;
advancing the implant insertion instrument so as to advance the secured intervertebral implant until the upper surface faces the first vertebra, the lower surface faces the second vertebra, and both the recess and the portion are positioned within a cutout defined by one of the first and second vertebrae; and
removing the portion of the implant insertion instrument from the cutout by removing the portion of the implant insertion instrument from the recess.

19. The method of claim 18, wherein during each of the inserting, advancing, and removing steps, the portion of the implant insertion instrument does not come into contact with either the first vertebra or the second vertebra.

20. The method of claim 18, further comprising, before the advancing step, the step of forming the cutout in one of the first and second vertebrae.

21. The method of claim 18, further comprising after the inserting step, the step of securing the implant insertion instrument to the intervertebral implant by moving the portion within the recess such that a projection carried by one of the portion and the intervertebral implant enters an indentation within the other of the portion and the intervertebral implant and blocks relative movement of the implant insertion instrument and the intervertebral implant in a direction opposite the first direction.

22. The method of claim 18, wherein the portion is a first portion, the recess is a first recess, and the cutout is a first cutout, the method further comprising the steps of:
inserting a second portion of the implant insertion instrument into a second recess of the intervertebral implant, the second recess being open to the trailing end and positioned substantially equidistantly between the first and second side surfaces with respect to the second direction, and the second recess being spaced from the first recess;
advancing the implant insertion instrument and the intervertebral until both the second recess and the second portion are positioned within a second cutout defined by the other of the first and second vertebrae; and
removing the second portion of the implant insertion instrument from the second cutout by removing the second portion of the implant insertion instrument from the second recess.

23. The method of claim 18, wherein the inserting step includes securing the upper surface relative to the lower surface such that the upper surface is not movable with respect to the lower surface, and the removing step includes unsecuring the upper surface relative to the lower surface such that the upper surface is movable with respect to the lower surface.

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